AN OVERVIEW OF THE SILENT INSPECTOR (SI) INSPECTION & CERTIFICATION PROCESS FOR HOPPER DREDGES AND SCOWS

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ABSTRACT

The US Army Corps of Engineers (USACE) Silent Inspector (SI) program was implemented on a national basis starting in 2006 with scows and hopper dredges. A critical component of the SI program is the inspection process. The quality assurance inspections insure that all SI-related equipment is capable of producing and reporting data to specified standards of accuracy, and verify that supporting documentation is reflective of system operations. To assist USACE personnel, Evans-Hamilton, Inc. (EHI) was contracted to conduct SI inspections on an as-needed basis. The purpose of this paper is to outline the inspection process for the SI program. In order to present a clear picture of this process, four major topics will be covered:

- Roles and responsibilities of the SI support team (including the inspector), the dredge contractor, and local districts, as outlined by the USACE.
- The methodology of an inspection including a description of the specific points covered during an inspection and the documentation the inspector will need as part of the inspection process.
- Progress made over the past year in the SI inspection process. Examples of lessons learned by inspectors over the past year will be provided.
- Future improvements to SI.

Keywords: Dredging, Dredge Plant Instrumentation Plan (DPIP), monitoring system, roles and responsibilities, lessons learned, progress

INTRODUCTION

The Silent Inspector (SI) is an automated dredge monitoring system which standardizes the collection of digital data from dredges and scows and compiles it into a centralized database. This database can then be used by local USACE districts to aid onsite inspectors, project managers and district planners.

Over the past year, Evans-Hamilton, Inc (EHI) has assisted the USACE in the inspection of SI systems on both hopper dredges and scows. In conjunction with the USACE, EHI has helped to streamline and standardize the inspection process while simultaneously revising the SI specifications. This has resulted in transparency in requirements and a performance-driven specification which allows the dredge contractor flexibility in design. In order for the SI system to work efficiently, coordination and communication between local districts, contractors, and the SI support center (located in Mobile AL) are crucial.

ROLES AND RESPONSIBILITIES

The USACE has attempted to clearly present and streamline the steps needed for the successful execution of the SI program for a dredging contract. Two flow charts are currently being developed to address these needs. The tables shown below have been created from these flow charts. They document the order of events needed for the SI program to be implemented seamlessly. Table 1 outlines the steps needed during a dredging project for SI implementation. The steps are arranged in chronological order and present the actions required and responsible

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party. As part of the SI program, the systems used to report the data to SI on the hopper dredges or scows must be certified annually to assure continued compliance with data requirements. This is a separate process and it has been outlined in Table 2. The SI system on a hopper dredge or scow does not need to be inspected for each individual project if it already has a current SI certification that meets the projects requirements.

Table 1. SI Implementation procedures for contracts.

Step	Responsible Party	Actions
1	Local USACE District Office	• Obtain Latest SI Specifications from SI Website (specifications.asp) or SpecsIntact • Tailor Specifications for Project Specific Needs/ Contract Requirements/ Environmental Coordination • Bid/Contract Award - MIPR Funding to SI Center
2	USACE Field Office	Notify SI Center of Project/Permit Issuance via e-mail (si-support@usace.army.mil) Include: • Field office POC* for each contract, • project name, • contract no./permit no./action ID, • contractor, • dredge name, • location, • start date *Field office POC included in all communication with Contractor
3	USACE Field Office	POC Coordinates with District GIS Coordinator and Provides Mapping Data to SI Center (if the district needs require) Include: • Disposal area coordinates, • station no.'s, • navigation aids, • shoreline, etc…
4	SI Support Center	SI Center Loads Mapping Data
5	SI Support Center	Center Provides Dredge Certification Status via e-mail to District/Field Office POC
6	USACE Field Office	POC Contacts Contractor with Certification Issues
7	Dredging Contractor	Contractor Submits DPIP or DPIP Addendums* to SI Center *Any changes since last certification
8	USACE Field Office	POC Provides Any Mapping Data Updates to SI Center (if the district needs require)
9	Dredging Contractor	Contractor Runs Quality Control Checks Prior to Operation and Updates SI Ship Server* *Oversight by USACE Field Office
10	Dredging Contractor	Contractor performs Quality Control Checks Throughout Project* - Frequency Based on Project *Oversight by USACE Field Office
11	USACE Field Office SI Support Center	POC Notify SI Center Dredging Initiated SI Center Notify POC Initial Data Received
12	Dredging Contractor	Contractor/Permittee Submit SI Data and Backup Daily
13	USACE Field Office	POC/SI Center Monitor and Review SI Data Daily (and as needed for permit job)
14	Dredging Contractor	Contractor Monitor/Review Contractor Data Daily
15	SI Support Center	SI Center Notifies Field POC of Data Issues
16	Dredging Contractor	Contractor Notify District/Field POC of Down Sensors and Environmental Issues

17	USACE Field Office	POC Notify SI Center & District Environmental POC of Project Completion
18	Dredging Contractor	Final SI Data Submittal and Backup – Entire Project

Table 2. SI Annual certification procedure.

Step	Responsible Party	Actions
1	Dredging Contractor	*One Month prior to Certification renewal date* Contact SI Support Center Provide the following information: • Proposed location for inspection • Points of Contact • Contractor • Jobsite • Local USACE Representative • Two potential Inspection dates (coordinated with Local USACE District) SI System Provider
2	SI Support Center	Contacts Inspection Contractor (Evans-Hamilton, Inc.) to coordinate schedule and then notifies Dredging Contractor and Local USACE District of intended date of inspection
3	Dredging Contractor	*Two Weeks Prior to Inspection* DPIP provided to SI Support Center
4	Inspection Contractor	Coordinates with Dredging Contractor specifics of time and location of inspection, including: • where to meet launch, • what time to meet launch, contact for launch
5	Dredging Contractor	*Inspection Date* Personnel on site who are familiar with the instrumentation AND • For hoppers- the ability to see material recovery and hopper open • For scows- a tug available to move scow to test tracking, the ability to open and close the bin, and for TDS profiles, a means of filling the bin with water and emptying it
6	Inspection Contractor	On-site Inspection performed: • For Hopper Dredges - Position Check, Draft Check, Ullage Check, Dragarm Depth Checks, Water Test, DPIP check, TDS Check, Download Backup Data • For Scows - Position Check, Dynamic Positioning Check, And as needed for profile; Open Close Check, Draft Check, Ullage Check, ,Water Test, DPIP check, TDS Check Verbal Summary of Inspection results given to Contractor and local USACE Representative prior to leaving the plant
7	SI Support Center	*Within 2 weeks following the Inspection* Inspection report reviewed and forwarded to Contractor and local USACE district where inspection was performed
8	Dredging Contractor	Follow-up on deficiencies noted in report
9	Local USACE District	*Deficiencies Addressed* If necessary, run any QA checks to verify corrections Document

		and notify SI support center of results
10	SI Support Center	*All Deficiencies Addressed* Issue Letter of Annual SI Certification

METHODOLOGY OF AN INSPECTION

An inspection is needed to insure that the instrumentation onboard a dredge plant is capable of producing quality data. These inspections currently fall under two major categories, hopper dredges and scows. Though both sets of inspections are similar in scope, each presents its own unique challenges and will be addressed separately in this section. Ultimately, each inspection will verify proper instrument documentation, quality data reporting throughout the operating range of the instrument, and complete data transmission.

Hopper Dredge Inspections

The order in which an inspection is performed is not crucial, as long as all of the objectives are achieved. All ullage, drafts, displacement, and hopper volume readings, both measured and electronic (from the SI computer), will be recorded with the hopper light and loaded with in-situ water. A draghead depth check will be conducted manually, checking depth at three intervals in the dredge's current operating range. The draft and ullage measurements are used to calculate a comparison of hopper volume and change in displacement. This difference should be within 5.0%. The sensors are also checked to be within the stated levels of accuracy. If pertinent, sea conditions can be taken into account. The DPIP will be checked against the DPIP check list in the SI specifications, verifying information such as sensor types, locations, logic, etc. The data on the SI computer will be backed up and sent to the SI support center.

A typical hopper dredge inspection is conducted as follows: Prior to an inspector's arrival, all sensors are checked and calibrated by the Contractor, if needed. Any changes to the DPIP are submitted to the SI support center and schedules are coordinated for an inspection date. Once inspectors arrive at the hopper dredge, they meet with the captain and talk though the inspection process. With the dredge light and washed clean of dredge material, the hopper is filled with just enough water so that the ullage sensors have a uniform fore and aft surface to provide a consistent measurement, and manual soundings can be taken relative to the hopper datum (zero ullage) in the vicinity of the sensor. Three soundings are taken forward and aft, at port, starboard and centerline. On some dredges this is not possible and either port/starboard or centerline soundings will be taken. A representative of the SI support team and a crew member, familiar with sounding the hopper, record the soundings. While these measurements are being taken, the launch will read the draft marks in feet and tenths of feet. These manual draft measurements are coordinated by the second SI inspector on the bridge. They are taken simultaneously with the ullage measurements to insure that the readings are reflective of a steady state ship. The inspector on the bridge also records the corresponding electronic readings from the SI computer. The hopper is then filled with water and the above steps are repeated. While the hopper is full, a small water sample from the hopper is collected to calculate the specific gravity of water.

The draghead depth check is conducted with the hopper full of water so that the deck edge is close to the waterline (making the draghead measuring device easier to read). The draghead is checked at three depths evenly spaced within the operating range for the project. If the draghead sensor is out of the acceptable margin of error (+/-0.5 ft) then it will need to be calibrated. Upon completion of the draghead depth check, the manual vs. the electronic readings for both light and loaded from all other sensors in the inspection are compared. If any sensor is out of calibration, it will need to be calibrated and rechecked. It is sometimes possible to perform this procedure while material is being dredged. If a draft or ullage sensor is out of calibration, the numbers for the water test will need to be recalculated since reported hopper volume and dredge displacement will not be an accurate reflection of dredge state. The GPS location will also be verified and the DPIP reviewed to insure all information included is an accurate reflection of the SI system on the dredge. Sensor logs are checked and noted.

Scow Inspections

Scow inspection requirements will vary based on profile type. There are four profile types which can be chosen based on the needs of the local USACE District. Levels of certification from least to most complex are as follows:

Tracking Profile

A Tracking Profile inspection will document the angle that the hull status sensor registers open and closed. In order to test the GPS, a static position will be compared at the dock, and then a dynamic position comparison will be performed. For the dynamic test, the inspector's GPS unit will be mounted on the scow and will continuously collect position data while the scow transits to and from the dump site (or equivalent, with inspector's approval). These data will then be plotted and compared with the GPS data from the SI system. Finally, the DPIP will be reviewed to verify that all information is included and is an accurate reflection of the SI system on the scow, and the sensor log will be checked to verify instrument calibration.

Monitoring Profile

A Monitoring Profile inspection will include all of the components of the tracking profile. Additionally, the draft sensors are inspected and required to be within specified standards of accuracy throughout the measurable range when compared to manually read draft marks on the scow.

Ullage Profile

An Ullage Profile inspection will include all of the components of the Monitoring and Tracking Profiles. Additionally, the ullage sensors are inspected and required to be within the specified standards of accuracy throughout the measurable range when compared to the average fore and aft manual bin measurement.

TDS Profile

The TDS profile inspection will include all of the components of the previous inspections, in addition to a hydro test. The hydro test is similar to a hopper dredge water test and the inspection works best if carried out in the same manner as described in the previous section, "Hopper Dredge Inspections". This inspection will verify that the ullage and displacement measurements correlate with the respective tables (included in the DPIP) to within +/-0.5%

LESSONS LEARNED AND PROGRESS MADE IN THE SI INSPECTION PROCESS

Many of the lessons learned are incorporated in the new version of the SI specification (spec) that is currently available at the SI website. The two biggest changes to the spec that affect inspections are organization and importance of performance standards. The spec has been revamped and reorganized so that requirements are more easily identifiable. The spec also states levels of accuracy required for the instrumentation and does not specify sensor type, allowing the industry to take advantage of any technology that may benefit the contractor. Additionally, reported units are standardized so that settings will not have to be changed as the dredge transitions from one project to the next. Some other changes include organizational requirements for the DPIP, which streamlines and reduces review and inspection time. Another change is the requirement for sensor logs to contain a history of sensor calibration repair and replacement. This log gives the inspector information needed to verify sensor calibration and aids the dredger in identifying recurring problems. The spec also includes clarification of what will be expected during quality assurance checks for all profile types

Coordination between the SI support center, local USACE District, and the dredge plant has been a challenge. The SI Support Center has attempted to resolve this issue using the two outlines provided above in the Roles and Responsibilities section of this paper. These outlines are used to clarify the chain of communication and the reasons for its execution in the provided order.

Improved communication between the SI Support Center and the dredge contractor and the dredge contractor and its on-site operators is critical. One area in which dredging companies can improve the inspection process is by making sure the dredge captains and project managers know what to expect during an inspection and keeping employees informed as to when inspectors will be arriving on site. A common misconception about the inspection process is that the inspections are performed to calibrate sensors. This is not the case; rather, part of the inspection includes documenting that sensors have been calibrated and are working properly. Another example of a common delay that could be alleviated through better communication is the contractor not having onsite certain equipment (tug, pump, etc…) because he was unaware before the inspection that the scow will need to be opened and closed (if it is a dump scow) and that the scow will have to be moved for the dynamic GPS test.

The SI support team has also learned that contractors are finding it more cost effective to implement SI systems on scows on a job-by-job basis. This has made coordination at the start of a contract critical to make inspections happen in a timely manor.

All SI inspection sheets have been standardized and streamlined. The inspection sheets now have version numbers associated with them so that any updates can be tracked accordingly. These sheets are also available for inspectors to review prior to the next annual inspection and are kept on file at the USACE SI Support Center.

Over the past year, SI inspections have been made on all industry hopper dredges and all USACE hopper dredges that have SI systems installed,. Additionally the team has inspected 30 scows. The inspection process has been refined and SI Support Team inspectors from EHI have been trained on the East Coast, Gulf Coast, and West Coast resulting in quicker response time. All inspections have been standardized and the procedures have been posted on the web so all USACE districts can utilize them to insure quality data throughout their dredging contract. The SI Support Center performs some standard QA checks on the incoming data to insure that all sensors are reporting. Additionally, the latest version of the SI specification has been updated on the web so that dredgers, districts, and inspectors have a clear picture of what is expected from the SI system.

FUTURE IMPROVEMENTS TO SI

Improvements to SI in 2008 will be evident in inspections and specifications. As the new versions of the specifications are included in more contracts, inspection time should decrease since all dredge plants and DPIP's will be organized in a uniform manner. Inspectors will have the information from prior inspection sheets available to them, enabling consistency with the prior year's inspection. The SI support center will work closely with local USACE Districts to make sure any deficiencies are addressed.

The SI support center is looking into ways to automate manual backups for hopper dredges and hope to improve the SI software's functionality with regards to data access. GIS capabilities are being investigated, as well as data accessibility for inspectors outside of a USACE network. The SI support center will also release specifications for implementation of SI systems on hydraulic and mechanical dredges.

CONCLUSIONS

As the implementation of the Silent Inspector program is adopted nationwide changes have been made to the specifications and inspection process. The SI Support Team has consulted with industry and vendors before any of these changes took effect. Care was taken not to change scope or accuracies but to clarify requirements, creating a performance based specification allowing for SI adaptation as future technologies emerge. As the roles and responsibilities become a standard, inspections and implementation will streamline. The SI Support Team hopes improvements over the next year will make SI the tool of choice for dredge data. Specifications and inspection requirements are listed on the SI web-site (http://si.usace.army.mil), and the SI Support Team is always available for questions. As SI moves into another year, its functionality will continue to improve and annual certifications will continue. Cooperation between dredging contractors, local districts and the regional SI center helps all parties achieve their goals in a timely and cost-effective manner.